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(54) **BIN WASHER DEVICE WITH ROTATING BIN HOLDER AND METHOD OF WASHING BINS**

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B08B 3/00 (2006.01)

(52) **U.S. Cl.**
USPC **134/124**; 134/23; 134/62; 134/128

(58) **Field of Classification Search**
USPC 134/62, 79, 124, 128, 23
See application file for complete search history.

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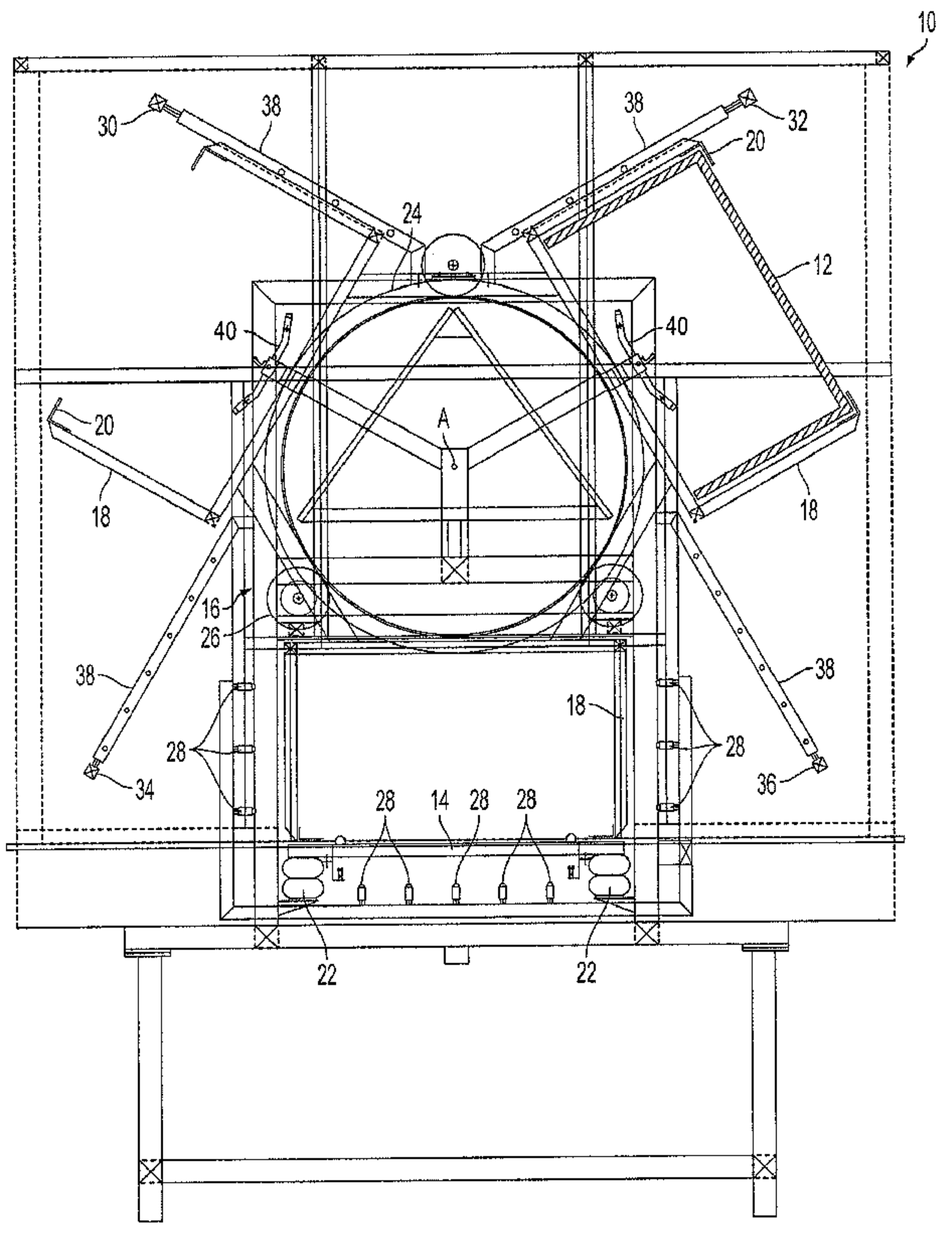
(57) **ABSTRACT**

A bin washer device for washing bins including a conveyor for moving the bins in a conveying direction, a support and at least two bin holders rotatably supported on the support for rotation about an axis adjacent the conveyor.

12 Claims, 4 Drawing Sheets



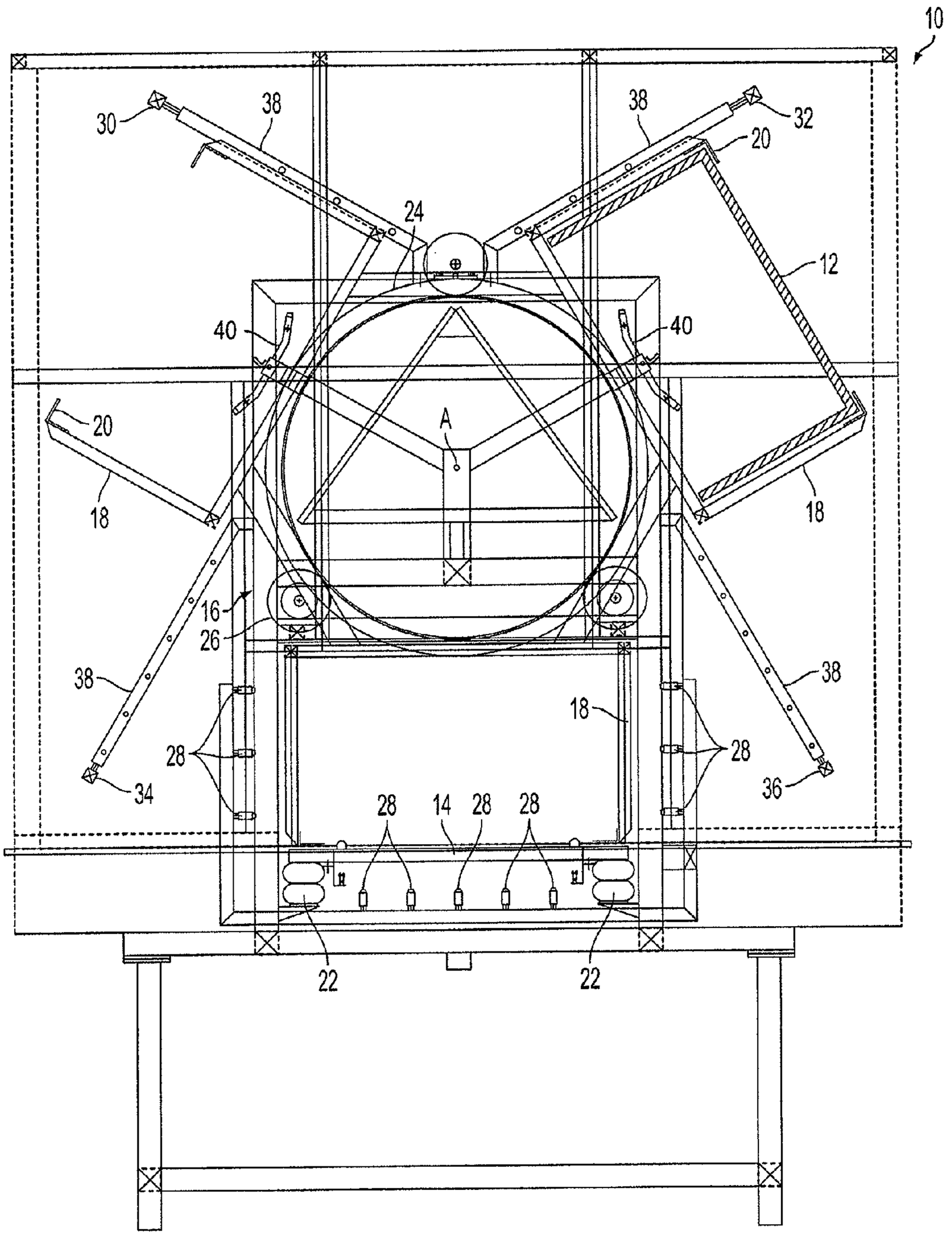

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FIG. 1

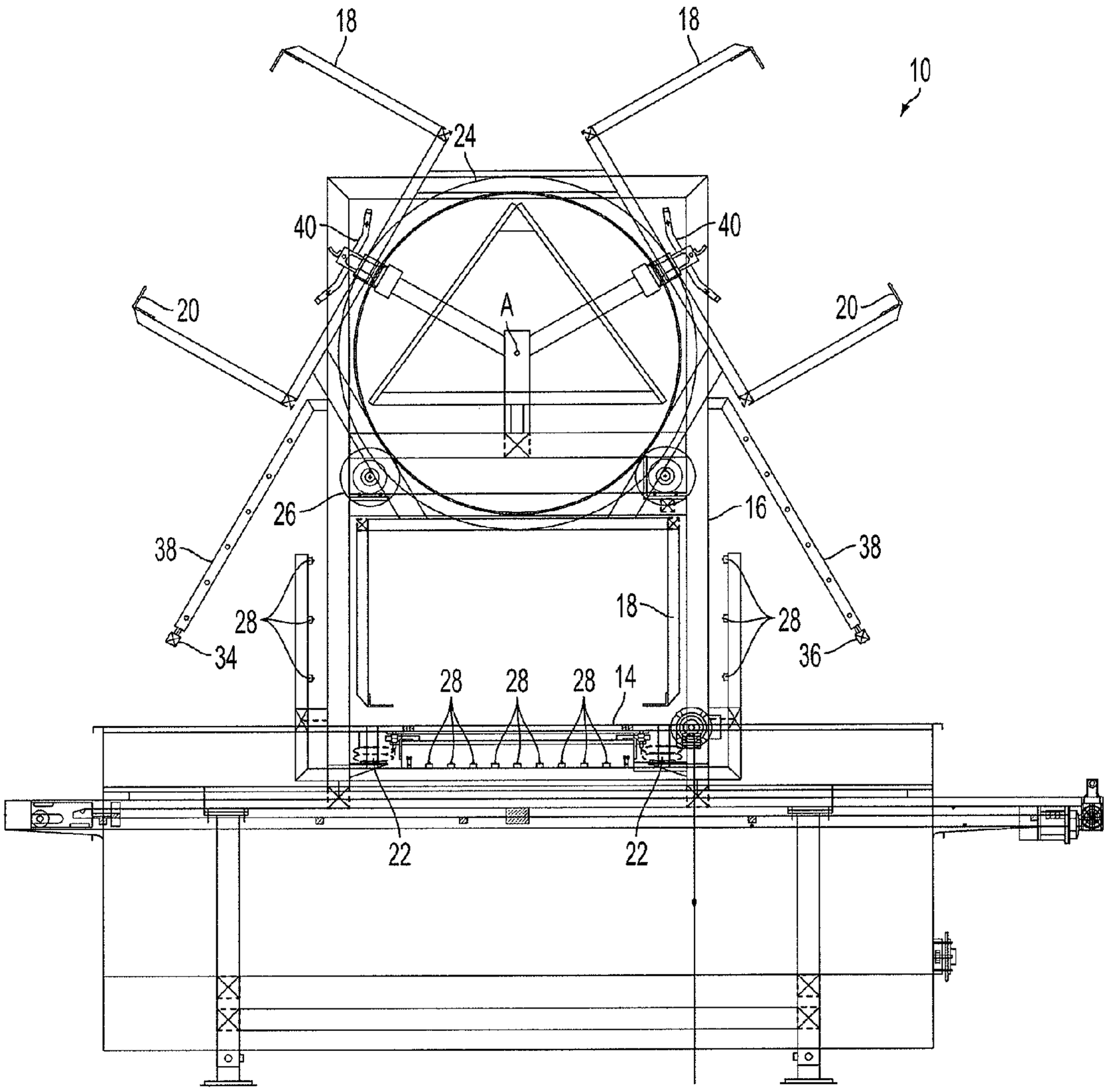

FIG. 2

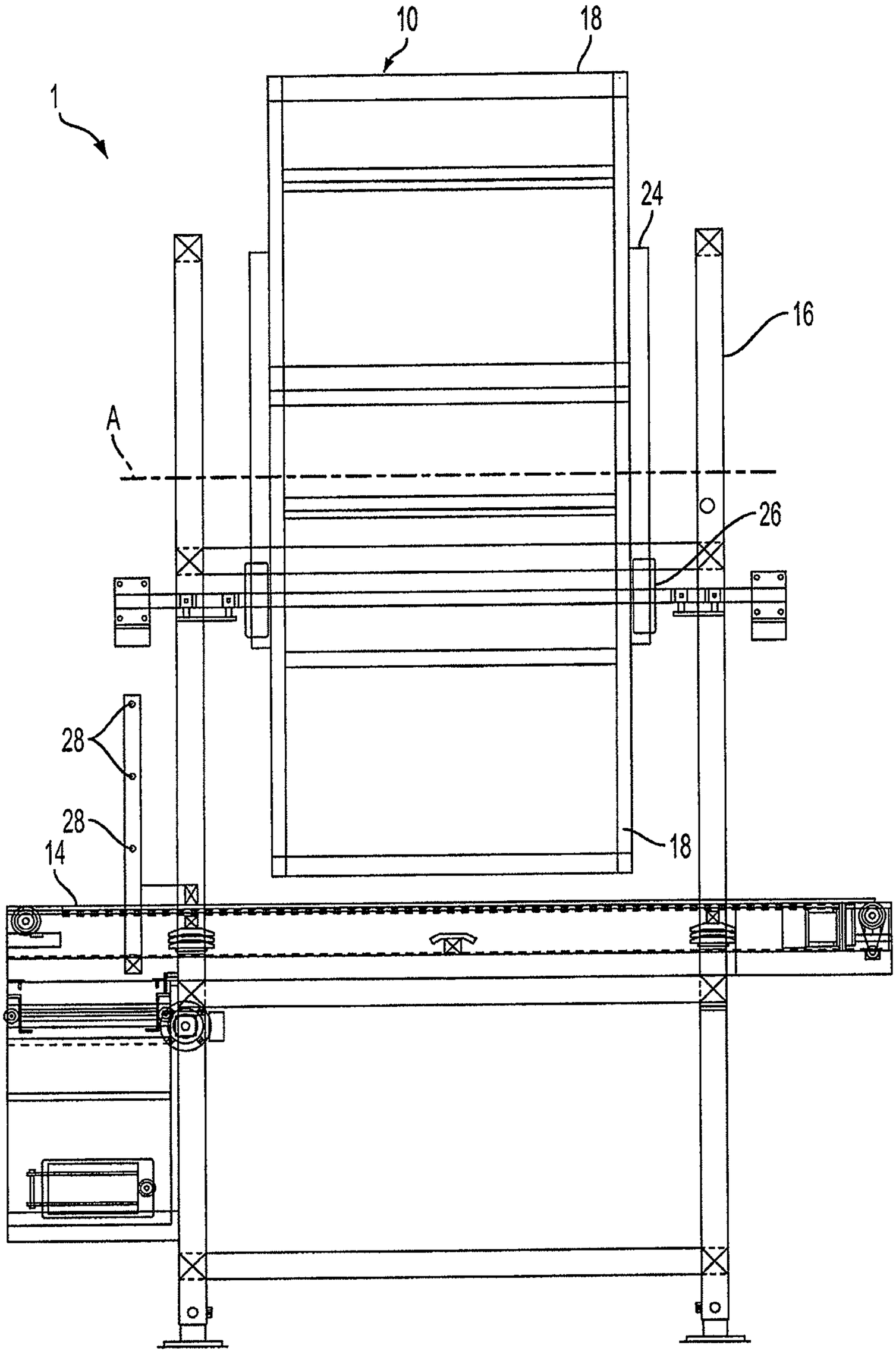

FIG. 3

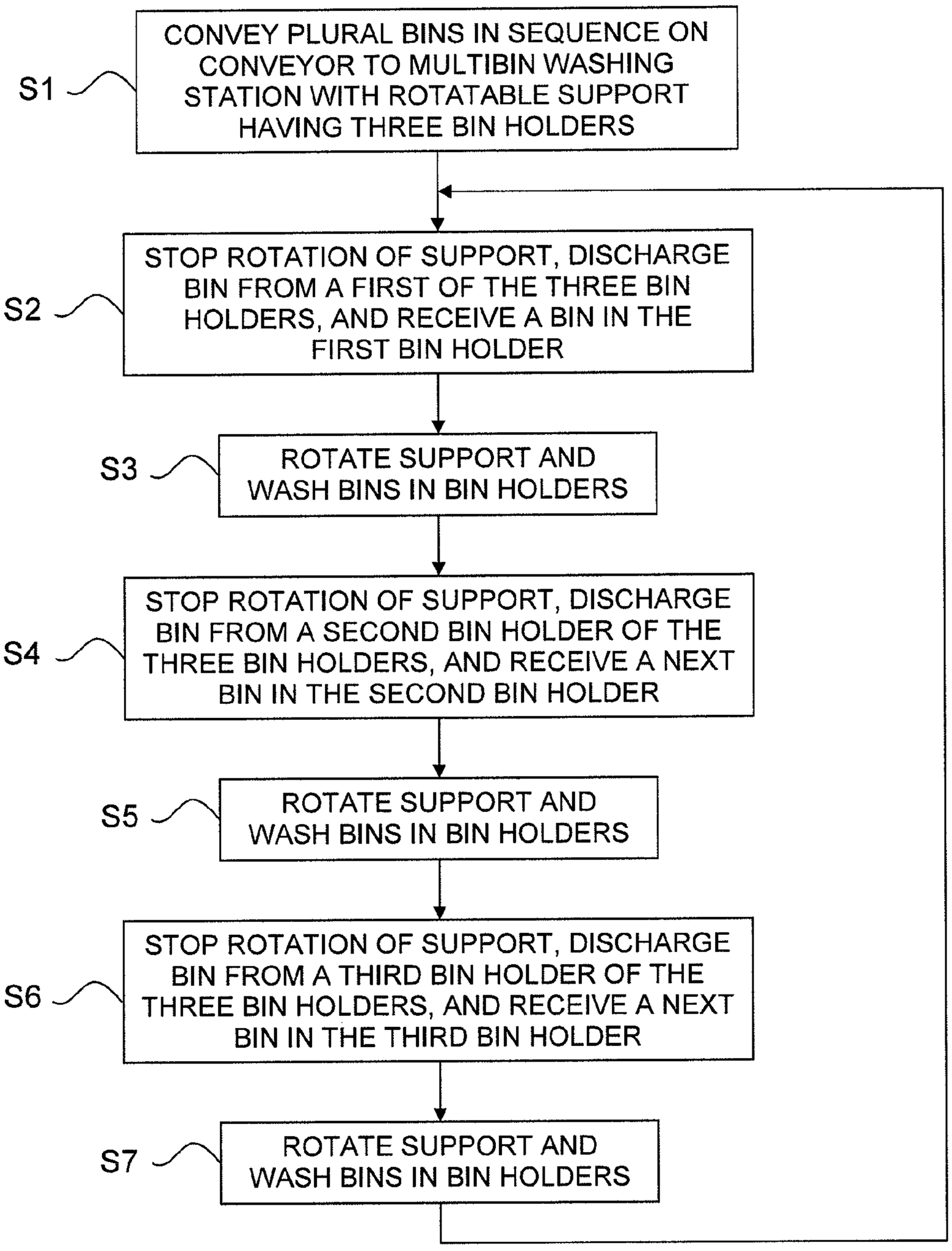
S1
CONVEY PLURAL BINS IN SEQUENCE ON CONVEYOR TO MULTIBIN WASHING STATION WITH ROTATABLE SUPPORT HAVING THREE BIN HOLDERS
S2
STOP ROTATION OF SUPPORT, DISCHARGE BIN FROM A FIRST OF THE THREE BIN HOLDERS, AND RECEIVE A BIN IN THE FIRST BIN HOLDER
S3
ROTATE SUPPORT AND WASH BINS IN BIN HOLDERS
S4
STOP ROTATION OF SUPPORT, DISCHARGE BIN FROM A SECOND BIN HOLDER OF THE THREE BIN HOLDERS, AND RECEIVE A NEXT BIN IN THE SECOND BIN HOLDER
S5
ROTATE SUPPORT AND WASH BINS IN BIN HOLDERS
S6
STOP ROTATION OF SUPPORT, DISCHARGE BIN FROM A THIRD BIN HOLDER OF THE THREE BIN HOLDERS, AND RECEIVE A NEXT BIN IN THE THIRD BIN HOLDER
S7
ROTATE SUPPORT AND WASH BINS IN BIN HOLDERS

FIG. 4

BIN WASHER DEVICE WITH ROTATING BIN HOLDER AND METHOD OF WASHING BINS

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

Illustrative, non-limiting embodiments of the present invention relate generally to a bin washing device, particularly, for washing bins used to convey plant products, such as fruit.

2. Background of Related Art

During fruit packing and processing operations, the fruit is typically stored or transported in bins, which are typically about 48"×48"×30" deep and which after use for storing or transporting the fruit, must be washed in order to remove plant residue, mold, decayed material, dirt, leaves, twigs and the like. The washing process must be efficient and involve a minimum of human activity. Accordingly, bin washer devices have been incorporated into conveyor systems to facilitate automatic washing of the bins. In one conventional bin washer device, a bin is conveyed open side up to a washing station where it is rotated until its interior surfaces face down. The bin is then lifted to provide access to the internal surfaces. The bin interior is sprayed from below by a lower spray. Typically, a single overhead spray is positioned to spray water and sanitizer onto the outer surfaces of the bins. Thereafter, the bin is dropped back onto the conveyor or into a bin collecting area such as a bin stacker. With such an arrangement, only a single bin can be washed by a washing station at one time. That is, one bin must be completely washed before the next bin can begin to be washed.

In these bin washing devices, the time required to wash a single bin must be less than the time it takes a packinghouse to dump fruit from a single bin. For example, if a packinghouse is dumping fruit at 30 seconds per bin, conventional bin washers have less than 30 seconds to wash a bin. Furthermore, the time required to lift the bin is not part of the wash time, resulting in a relatively short wash time per bin.

Oftentimes with the conventional bin washers, pathogens are not effectively killed because the sanitizers cannot be applied to the bins for a sufficient amount of time. Furthermore, some of the bins have pocketed cleats and/or bin runners on a bottom surface of the bin. Dirt or mud and the like that becomes lodged in these cleats or runners is difficult to remove and the conventional bin washers do not effectively remove foreign material from these areas. Additionally, dried or decayed fruit on the internal and external surfaces of the bin can be difficult to remove and are not effectively removed with a short wash time or a single overhead spray.

Accordingly, there remains a need for an improved bin washer that can effectively remove dirt, plant residue, mold, decayed material, or dried fruit from all surfaces, both interior and exterior, of the bins and effectively kill pathogens, while performing such functions without slowing down the plant product dumping process.

SUMMARY OF THE INVENTION

Illustrative, non-limiting embodiments of the present invention overcome various of the foregoing and additional disadvantages and problems. In addition, the present invention is not required to overcome all these disadvantages, and an illustrative, non-limiting embodiment of the present invention may not overcome any problems, but may simply provide another way of performing a method or achieving a desired result.

An illustrative, non-limiting embodiment of the bin washer device comprises: a conveyor for moving the bins in a conveying direction; a support; and at least two bin holders rotatably supported on the support for rotation about a longitudinal axis.

An illustrative, non-limiting embodiment of the method of washing bins comprises: conveying the plural bins in sequence on a conveyor to a multibin washing station with a rotatable support having N bin holders, wherein N is an integer equal to 2 or more; stopping a rotation of the support; discharging one of the plural bins from an x one of the bin holders, wherein x is an integer from 1 to N; receiving a next one of the plural bins in the x one of the bin holders; and rotating the support and washing the bins in the bin holders. The stopping the rotation, the discharging the one of the plural bins, the receiving of the next one of the plural bins, and the rotating of the support and washing of the bins in the bin holders are reiterated sequentially for each value of x from 1 to N. The reiterating is repeated to continuously wash the bins.

The present bin washer device extends the wash time of each bin, allowing the sanitizer to effectively kill pathogens. Additionally, the present bin washer more effectively removes dirt and mud from the bins including that within the cleats, and removes dried or decayed fruit from the internal and external surfaces of the bin.

BRIEF DESCRIPTION OF THE DRAWINGS

Features and advantages of illustrative, non-limiting embodiments of the present invention will become more apparent from a reading of the following description. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate exemplary embodiments of the invention and, together with the description, serve to explain the aspects, advantages and principles of the embodiments. In the drawings:

FIG. **1** is a front cross sectional view of a bin washer according to an exemplary embodiment of the present invention illustrating a bin in one of the bin holders;

FIG. **2** is a front cross sectional view of a bin washer according to another exemplary embodiment of the present invention;

FIG. **3** is a side view of the bin washer of FIG. **2**; and

FIG. **4** is a flow chart illustrating a method of washing bins according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Illustrative, non-limiting embodiments of the present invention will now be described more fully with reference to the accompanying drawings.

FIG. **1** illustrates a bin washer device **10** that is disposed at a washing station **1** along a conveyor **14** for moving bins **12** in a conveying direction. The device **10** has a structural support **16** disposed at a location along the conveyor **14**.

A plurality of bin holders **18**, at least two and preferably three or more bin holders **18**, are rotatably supported on the support **16** and are all rotatable about a same longitudinal axis A that is disposed in a direction that is parallel to the conveying direction of the conveyor **14** and above the conveyor **14**. The bin holders **18** are radially spaced from and circumferentially arranged about the axis A and are spaced from one another. In FIG. **1**, the conveying direction of conveyor **14** is into the sheet. In the exemplary embodiments, each bin holder **18** comprises a member that is U-shaped in cross section and

has two open sides spaced from one another along the conveying direction, the opening in the sides being sized to receive an entire bin and to hold the bin in the U-shaped member.

The support **16** is structured to point rotation of the plurality of bin holders **18** in sequence to and from an entry position that is located directly below the axis of rotation A, out of the entry position into washing positions, and finally back into the entry position. In the entry position, the bin holder **18** receives a respective bin **12** while the bin **12** is face up, and thereafter rotates the bin **12** to washing positions where the respective bin **12** is sprayed. Once the bin holder **18**, holding a respective bin **12**, is moved back to the entry position, the bin **12** is conveyed away through the open side of the bin holder **18** by operation of the conveyor **14**. In the entry position, the U-shaped member is inverted with the opening facing down and its open sides positioned to receive a bin **12** as it is conveyed by the conveyor **14**. However, as would be clear to one skilled in the art, the bin holder **18** and support **16** are not limited to this construction and may be any structure capable of holding a bin in a rigid manner while rotating the bin in a path away from and back to the conveyor while washing the bin **12** during rotation.

As shown in FIG. **1**, the bin holders **18** are supported above the conveyor **14** at a predetermined distance wherein when one of the bin holders **18** is located directly below the axis of rotation A, a bin **12** held in that bin holder **18** (i.e., in an entry position) is in contact with the conveyor **14**.

In this manner, as the conveyor **14** conveys the bins **12**, the bins **12** freely move into and out of the open sides of the inverted U-shaped bin holder **18**. The bin holders **18** can effectively receive the bins **12** as they travel on the conveyor **14** and into the entry position, without altering the circular path of the bin holders **18** or the path of the bins **12**.

A fastening member **20** is disposed on each bin holder **18** which detachably attaches one of the bins **12** to the bin holder **18**. In the exemplary embodiments, the fastening member is a pair of flanges **20** that extends inwardly from and is rigidly attached to ends of the bin holder **18**. A flange **20**, for example, may be an angle iron. The bins **12** slide into the U-shaped bin holder **18** through an open side of the bin holder, wherein a bottom of the bin **12** rests on the flanges **20** such that the bin **12** moves with the bin holder **18** as the bin holder **18** rotates out of the entry position and into the washing positions, which may include washing, sanitizing, drying or similar processes.

A lifting mechanism **22** may be provided at an underside of the conveyor **14** to lift the bin **12** while in the entry position to assist the bin **12** when entering the bin holder **18**. The lifting mechanism **22** may be one of many known arrangements for lifting a structure, such as electrical, hydraulic, or mechanical. The lifting mechanism **22** is actuated at a timing based upon the conveyance of the conveyor **12** and the rotation of the bin holders **18**, such that a bin **12** is lifted as it is conveyed into the open side of the U-shaped bin holder **18** so that the bin **12** engages the fastening member **20**. In the exemplary embodiments, the bin **12** is lifted so that the bottom surface of the bin **12** is conveyed above the fastening member **20**.

An actuator which may be included (not shown) rotates the bin holders **18** about the axis A. The bin holders **18** may be supported about the axis A on a cylindrical support **24**, wherein the actuator rotates the cylindrical support **24** about the axis A. In the exemplary embodiment, the large cylindrical support **24** is a drum and a plurality of small cylindrical members **26** engages the drum, wherein the actuator rotates one or more of the small cylindrical members **26**.

A plurality of sprays **28**, **30**, **32**, **34**, **40** are provided adjacent the bin holders **18** for spraying water onto inner or outer surfaces of the bins **12**. The water may contain a sanitizer. In an exemplary embodiment, the water is screened to a minimum of 150 microns, to allow the water to be recycled all day long, while still being able to use the sanitizer effectively. A water holding tank (not shown) houses the water to be used in the device **10**. A heat exchanger (not shown) may be provided, to heat the water to allow for a higher degree of efficacy for killing pathogens, and/or removing soil or fruit debris. Preferably, the plurality of sprays **28**, **30**, **32**, **34**, **36**, **40** are each supplied with water through a single water supply unit, but a separate unit can alternatively be used.

The plurality of sprays **28**, **30**, **32**, **34**, **36**, **40** includes entry sprays **28** that are disposed in an array below the conveyor **14**, in arrays slightly above and adjacent each side of the conveyor **14**, and in an array directly above the conveyor. The entry sprays **28** spray water on the bottom surface, outer side surfaces, and the inner surfaces of a bin **12** which is in the entry position.

The plurality of sprays **28**, **30**, **32**, **34**, **36**, **40** includes a plurality of outer sprays **30**, **32**, **34**, **36** provided outside the path of the bin holders **18**. For example, upper outer sprays **30**, **32** may be provided overhead or above the bin holders **18**, and lower outer sprays **34**, **36** may be provided below or under the bin holders **18**. As shown in FIG. **1**, two upper outer sprays (one left upper outer spray **30** and one right upper outer spray **32**) are positioned at predetermined angles relative to a vertical axis extending upwardly from the conveyor **14** perpendicular to the axis of rotation A of the bin holders **18**. Two lower outer sprays (one left lower outer spray **34** and one right lower outer spray **36**) are positioned below the bin holders **18** at predetermined angles relative to the vertical axis. The position of a spray refers to the direction the spray nozzle is pointing, or the direction that water will be sprayed from the spray. Preferably, the angles of each spray are offset slightly from 45 degrees.

The two sprays **30**, **34** that are on the left side of the conveyor **14** are positioned perpendicular to one another. Similarly, the two outer sprays on the right side **32**, **36** are positioned perpendicular to one another. In this manner, when the bin holders **18** are in a predetermined location of the path, one of the outer sprays on the left side sprays alongside a first side of the bin **12** while the other of the outer sprays on the left side sprays alongside a second side of the bin **12** perpendicular to the first side of the bin **12**.

In the exemplary embodiment, the left upper outer spray **30** is angled negative 50 degrees from the vertical direction, and the left lower outer spray **34** is angled positive 40 degrees from the vertical direction, wherein negative degrees denotes a counterclockwise rotation in FIG. **1** and positive degrees denotes a clockwise rotation in FIG. **1**. The right upper outer spray **32** is angled positive 50 degrees from the vertical direction, and the right lower outer spray **36** is angled negative 40 degrees from the vertical direction.

The outer sprays **30**, **34** that are on the left side of the conveyor **14** are positioned at angles that mirror the respective outer sprays **32**, **36** on the right side of the conveyor **14**. In other words, the orientation of the upper outer spray **30** on the left side of the conveyor **14** mirrors that of the upper outer spray **32** on the right side of the conveyor **14**. Similarly, the orientation of the lower outer spray **34** on the left side of the conveyor **14** mirrors that of the lower outer spray **36** on the right side of the conveyor **14**.

Because the sprays **32**, **36** on the right side of the conveyor **14** mirror the sprays **30**, **34** on the left side, as the device **10**

rotates, the right side sprays **32**, **36** spray water alongside two sides different from those that the left side sprays **30**, **34** sprayed.

The upper and lower outer sprays **30**, **32**, **34**, **36** have spray banks **38** extending at the angle of the spray nozzle toward the bin holder. The spray banks **38** are fixed relative to the support and guide water from the respective spray and spray the water in a direction perpendicular to the respective spray. The outer sprays provide an intense volume of liquid, for example, approximately 120 gallons of water per minute.

As shown in FIG. **1**, the plurality of sprays **28**, **30**, **32**, **34**, **36**, **40** includes inner sprays **40** positioned at a location inside the outer periphery of the path of the bin holders **18**. The inner sprays **40** are disposed on each bin holder **18** and travel with the bin holder **18**. Preferably, the inner sprays **40** are rotary sprays that rotate while traveling with the bin holder **18** and may provide, for example, approximately 200 gallons of water per minute.

The water supply unit (not shown) that supplies water to the plurality of sprays **28**, **30**, **32**, **34**, **36**, **40** is in communication with the water tank and by way of example, may run a total pressure of 50-60 lbs. To provide this overall system pressure, firstly the ideal size for the inner sprays **40** and outer sprays **30**, **32**, **34**, **36** is determined that effectively cleans the bins **12**. Thereafter, the number of entry sprays **28** can be increased or decreased in order to obtain a total pressure of 50-60 lbs.

First solenoid switches (not shown) control the rotating of the bin holders **18**. Second solenoid switches (not shown) control the lifting mechanism **22**. The solenoids are timed such that a bin **12** is lifted and conveyed into a bin holder **18** in the entry position while the bin holder **18** is paused in the entry position.

In operation, a bin **12** moving along the conveyor **14** reaches the washing station **1** that includes the bin washer device **10**, and enters one of the bin holder **18** when the bin holder **18** is located directly below the axis of rotation A. In this entry position, the bin **12** is spray by the entry sprays **28**. Thereafter, the bin **12** is held by the bin holder **18** and rotates with the bin holder **18**. As the bin **12** rotates with the bin holder **18**, the bin **12** is sprayed by an inner spray **40**, and a plurality of outer sprays **30**, **32**, **34**, **36**. If the bin holder **18** is rotating in a clockwise direction in FIG. **1**, the bin **12** would be sprayed first by the left outer sprays **30**, **34**, wherein the left lower outer spray **34** would spray alongside the bottom of the bin **12** and the left upper outer spray **30** would spray alongside the forward-most side of the bin **12**. Lastly, the bin **12** would be sprayed by the right outer sprays **32**, **36**, wherein the right upper outer spray **32** would spray alongside the trailing side of the bin **12**, and the right lower outer spray **36** would spray alongside the bottom of the bin **12**.

A method of washing a plurality of bins **12** that extends the wash time of each bin **12** is illustrated in FIG. **4**. The exemplary embodiment of FIG. **4** illustrates a method using three bin holders, however, the method is not limited to a particular number of bin holders, provided there are at least two bin holders.

The exemplary embodiment of the method includes conveying the plural bins in sequence on a conveyor to a multibin washing station with a rotatable support having three bin holders in step S**1**. Next, the rotation of the support is stopped at step S**2**. While the support is stopped, one of the plural bins is discharged from a first one of the bin holders and another bin is received in the first bin holder at step S**2**. At step S**3**, simultaneously, the support is rotated and the bins in the bin holders are washed. At step S**4**, the rotation of the support is stopped, another one of the plural bins is discharged from a second one of the bin holders, and a next bin is received in the second bin holder. At step S**5**, simultaneously, the support is rotated and the bins in the bin holders are washed. At step S**6**, the rotation of the support is stopped, a bin is discharged from a third one of the bin holders, and a next bin is received in the third bin holder. After step S**6**, simultaneously, the support is rotated and the bins in the bin holders are washed at step S**7**. The stopping the rotation and the rotating of the support at steps S**2**-S**7** are repeated to sequentially washed the bins that are conveyed on the conveyor.

If the N bin holders is a number other than three, the support is stopped, one of the bins is discharged from an x one of the N bin holders, a next one of the bins is received in the x bin holder, the support is then rotated and the bins in the bin holders are washed, for each integer value of x from 1 to N. That is, the steps are reiterated for each respective bin holder. Furthermore, the cycle from x equal to 1 to N is repeated to continuously wash the bins being conveyed using a single washing station.

The bin washer design is unique in that a plurality of bins **12** rotate in an orbit above the entry conveyor **14** in a single bin washer device. This design allows a bin **12** to be staged in the washer longer than specified dump speeds of the packinghouse particularly because multiple bins **12** can be washed simultaneously by the same bin washer device **10**. In the exemplary embodiment, if fruit is dumped at a speed of 30 seconds per bin **12**, because three bins **12** are staged in the single bin washer device at one time, the washing time for each bin **12** is extended to almost 90 seconds, creating a longer dwell time to cleanse and sanitize the bin surfaces. Furthermore, due to the angles of the sprays, all sides of a bin **12** are thoroughly sprayed therealong.

Although the invention has been explained in relation to certain exemplary and preferred embodiments, it is to be understood that many other possible modifications and variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. A bin washer device for washing bins comprising:

a conveyor for moving the bins in a conveying direction;

a support frame disposed adjacent the conveyor and having a central axis of rotation;

at least two bin holders attached to the support frame and rotatable about the central axis of rotation of the support frame, wherein at least one of the bin holders is configured to remove a bin from the conveyor and invert the bin by moving the bin relative to the conveyor,

a plurality of outer sprays disposed outside a path of the bin holders and each positioned at a predetermined angle relative to a vertical direction perpendicular to the central axis of the support frame,

wherein the central axis of the support frame extends parallel to the conveying direction of the conveyor,

wherein the plurality of outer sprays includes a plurality of upper outer sprays disposed at a first position and a plurality of lower outer sprays disposed at a second position below the first position,

wherein each of the upper outer sprays corresponds to one of the lower outer sprays and the angle of the upper outer sprays is offset by 90 degrees from the angle of the corresponding lower outer spray, and

wherein:

the plurality of upper outer sprays includes a left upper outer spray and a right upper outer spray,

the plurality of lower outer sprays includes a left lower outer spray and a right lower outer spray,

the angle of the left upper outer spray is a mirror-image of the angle of the right upper outer spray,

the angle of the left lower outer spray is a mirror-image of the angle of the right lower outer spray,

whereby as the bin holder rotates a bin the sprays spray alongside plural surfaces of the bin.

2. The bin washer device according to claim **1**, wherein the central axis of the support frame is disposed above the conveyor.

3. The bin washer device according to claim **1**, wherein the bin holders are radially spaced from the central axis of the support frame, and circumferentially spaced from one another.

4. The bin washer device according to claim **1**, further comprising a fastening member disposed on each bin holder which detachably attaches one of the bins to the bin holder.

5. The bin washer device according to claim **1**, further comprising three bin holders rotatably supported on the support frame.

6. The bin washer device according to claim **1**, further comprising an inner spray disposed on each bin holder.

7. The bin washer device according to claim **1**, further comprising an actuator which rotates the bin holders.

8. The bin washer device according to claim **7**, further I comprising a shaft that is rotatable relative to the support frame, wherein the actuator engages the shaft.

9. The bin washer device according to claim **7**, further I comprising a first gear supporting the bin holders around the central axis of the support frame, and a second gear engaging the first gear, wherein the actuator rotates the second gear.

10. A method of washing plural bins as according to the apparatus of claim **1**, comprising:

conveying the plural bins in sequence on a conveyor to a multibin washing station with a rotatable support having N bin holders, wherein N is an integer equal to 2 or more;

stopping a rotation of the support;

discharging one of the plural bins from an x one of the bin holders, wherein x is an integer from 1 to N;

receiving a next one of the plural bins in the x one of the bin holders;

rotating the support and washing the bins in the bin holders;

reiterating the stopping the rotation, the discharging the one of the plural bins, the receiving of the next one of the plural bins, and the rotating of the support and washing of the bins in the bin holders sequentially for each value of x from 1 to N.

11. The method of claim **10**, wherein N is equal to 3 or more.

12. The method of claim **10**, further comprising repeating the reiterating step.

* * * * *